REMARKS

In response to the Office Action mailed on April 14, 2006, the Applicant has made several amendments to the claims to comply with the Examiner's objections under 37 CFR 1.75(c). Additionally, Applicant has made a number of additional amendments to the claims which the Applicant believes clarify the language and which Applicant believes are not substantive changes.

In response to the Examiner's rejections under 35 U.S.C. §102(b) and under 35 U.S.C. §103, Applicant has provided below rebuttals to the Examiner's arguments which Applicant believes over the Examiner's rejections.

1. Objections under 37 CFR 1.75(c)

The Examiner has objected to claims 53 and 54 under 37 CFR 1.75(c) "as being in improper form...." Applicant has amended claim 53 by removing the phrase "as described in claim 13." Consequently, Applicant submits that the basis for this objection by the Examiner is overcome.

The Examiner has objected to claims 46 and 62 under 37 CFR 1.75(c) "because of the recitation of the clause "capable of mating"...." Applicant has amended both of these claims to remove that clause and replace it with "thermally coupled to." Consequently, Applicant submits that the basis for this objection by the Examiner is overcome.

The Examiner has objected to claim 48 under 37 CFR 1.75(c) because it "recites "first conducting material," which lacks antecedent basis. Evidently "first heat conducting material" should have been recited." Applicant has amended claim 47, on which claim 48 depends changing "first and second heat conducting regions" to "first and second electron conducting regions". Applicant has amended dependent (on claim 47) claims 48 and 49 to clearly recite the antecedent "first electron conducting..." and "second electron conducting...." Consequently,

Applicant submits that the basis for this objection by the Examiner is overcome.

2. Rejection of claims 46, 52 and 58-61 under 35 U.S.C. §102 (c)

The Examiner has rejected these claims as being anticipated by US/6,234,240 to Cheon (hereafter Cheon). With respect to claims 46 and 58-62 the Examiner has stated "Cheon disclosed (Fig. 2,3) a liquid cooling system for... comprising: a heat transfer unit (14, 22) operating under the peltier effect, ...a conduit (56,58) coupled to the hot region (16) and.....". Applicant submits that Cheon does not anticipate its invention.

Cheon describes two approaches to liquid cooling of heat generating components as summarized in Column 3, lines 19-40. The first is the well-known approach of coupling a heat transfer device (22) (or heat transfer unit or cold plate) to the component (10). Liquid is circulated through the cavity of the heat transfer device (22), absorbs heat from the component (10) and the heat is subsequently dissipated by a separate heat exchange system. The second approach described by Cheon is the same as the first except a Peltier thermoelectric cooler (14) is disposed between the heat transfer device (22) and the component (10).

Applicant's invention, as stated in claim 46, and described throughout the application, uses the cold and hot regions (of an electron conducting material) to transfer heat from the heat generating component directly to a conduit having the coolant flowing there through. The coolant absorbs the heat and a separate heat exchange system dissipates the heat (e.g. see Figure 6 of the application). Applicant has thus eliminated the heat transfer device (22) of Cheon. Eliminating the heat transfer device 22 is a significant advantage as will be obvious to anyone skilled in the art.

The examiner has stated that Cheon has a heat transfer unit comprised of heat transfer device (22) and a Peltier thermoelectric cooler (14). In claim 46, Applicant states that the heat transfer unit operates under the Peltier effect. Cheon's heat transfer device (22) (to which, conduits 56 and 58 are connected) does not operate under a Peltier effect. The Examiner has

attempted to define Cheon's heat transfer unit as the combination of a standard liquid cooled heat transfer device (22) and a Peltier thermoelectric cooler (14). No where in Cheon is it stated or implied that the heat transfer device (22) is or can be eliminated.

Moreover, in claim 46, Applicant recites a conduit coupled to the hot region. Contrary to the examiner's assertion that, in Cheon, conduits 56 and 58 are coupled to the hot region (16), Cheon clearly teaches and even claims the conduits being connected to the heat transfer device (22) and not to the hot region (16).

Consequently, Cheon does not teach Applicant's invention. For both implementations of Cheon (i.e. with the Peltier thermoelectric cooler (14) and without the Peltier thermoelectric cooler (14)), the conduits (56 and 58) are connected to the heat transfer device (22). Thus, Cheon does not teach or suggest the conduit being coupled to the hot region (16) of the Peltier thermoelectric cooler (14). Applicant submits that, since Cheon teaches the use of traditional heat transfer device (22), Cheon cannot anticipate Applicant's "conduit coupled to the hot region...." Applicant submits then, that the Examiner's rejection of these claims based Cheon is overcome and these claims are in condition for allowance.

Applicant further submits that, in Cheon, an addition material, the Peltier thermoelectric cooler (14), has been inserted between the heat transfer device (22) and the component (10), thereby increasing the thermal resistance of the thermal coupling. Applicant's invention teaches the conduit coupled directly to the hot region (of the electron conducting material) with less thermal resistance and more heat transfer.

Applicant further submits that the Peltier thermoelectric cooler (14) as described and depicted in Cheon will not operate very effectively, if at all, alone (i.e. without the traditional heat transfer device (22)) as a heat transfer unit. Cheon depicts the electron flow of the Peltier thermoelectric cooler (14) between the hot region (16) and the cold region (18) as traversing the smallest dimension (i.e. the thickness) of Peltier thermoelectric cooler (14) as opposed to along the length or width of the electron conducting material as taught in Applicant's invention..

Consequently, Applicant submits that this is a further basis for its argument that Cheon does not anticipate Applicant's invention as claimed.

The Examiner has stated that with respect to claim 52, "Cheon disclosed ... wherein the inlet is disposed below the outlet (Fig. 3) for enhancing convective flow of the liquid (inherently)." Applicant submits that since its claim 46, on which claim 52 depends, is in condition for allowance, this rejection is now overcome.

Moreover, Applicant submits that in Fig. 3 of Cheon, the inlet to heat transfer device (22) and the outlet to heat transfer device (22) are essentially shown at the same height and not with the inlet below the outlet. Moreover, no where in Cheon is there any mention of convective circulation nor is anything shown or described that convective circulation was even contemplated. On the contrary, in Fig. 6 of Cheon, two heat transfer devices (22 and 22') are shown. Referring to col. 4, lines 49-65, Cheon clearly states that conduit (54) connects the outlet (port) (28) of device 22 to the inlet (port) (26) of the second device (22'). Clearly then, the inlet (port) (26) of device (22) is depicted above the outlet (port) (28). Consequently, Applicant submits that Cheon does not teach (inherently or otherwise) positioning of the inlet below the outlet to enhance convective circulation.

With respect to claim 62, the Examiner has stated that the method steps are inherently necessitated by the device structure as taught by Cheon. Applicant submits that, since Cheon does not anticipate the conduit coupled to the hot region and in consideration of Applicant's arguments above with respect top claim 46, the method steps of claim 62 are not inherently necessitated by Cheon. Applicant submits then, that its claim 62 is in condition for allowance.

Applicant respectfully submits then, that its claim 46, all dependent claims thereon and claim 62 are not taught or anticipated by Cheon and are in condition for allowance.

3. Rejection of claims 47-51 and 55-57 under 35 U.S.C. §103

The Examiner has rejected claims 47-51 and 55-57 under Section 35 U.S.C. § 103(a) as being unpatentable over Cheon in view of Law et al. (Law) (US/6,711,904).

Since Cheon does not anticipate the conduit coupled to the hot region in Applicant's claim 46 and on which all of these claims depend, it can not anticipate these claims 47-51 and 55-77 alone or in combination with Law. Law clearly does not teach or anticipate a conduit coupled to the hot region in Applicant's claim 46 and subsequent dependent claims.

Moreover, Law does not even teach a liquid cooling system. Law teaches a heat sink system: namely where a heat sink thermally coupled to the heat-generating component is used to "dissipate" the heat. At column 4, lines 34-63 of Law, a brief mention is made of converting the heat sink into what those skilled in the art call a heat pipe; namely, where different cooling techniques can be applied to cool the fins of the heat sink, including liquid. Both heat sinks and heat pipes are known by those skilled in the art to be different than liquid cooling systems. A liquid cooling system uses the liquid to absorb heat for transport to a dissipater to be cooled. In a heat pipe, the fin structure is the dissipater and the liquid or other cooling mechanism is used to cool the dissipater.

The examiner states that " Since Law and Chen are from the same field of endeavor (cooling systems utilizing peltier devices), the purpose of utilizing a plurality of peltier heat transfer materials taught by law would be recognized in the Cooling system of Cheon. It would have been obvious to a person of ordinary skill in the cooling art at the time the invention was made to substitute the peltier heat transfer material (14) of Chen with a plurality of peltier heat transfer materials of law, in order to provide appropriate cooling for different regions of the processor (see Law, column 10, lines 41-51)."

Applicant's submits that, since Law teaches a heat sink or a heat pipe system, it is not inherently applicable to a liquid cooling system. Moreover, one skilled in the art of cooling would know the configurations shown in Law, with its many layers of peltier, insulating and non-insulating materials, etc. would be undesirable in a liquid cooling system since the increased thermal resistance caused by adding all of these layers has an undesirable effect. In applicant's

invention, the electron conducting material (e.g. peltier device) is used to facilitate the transfer of heat from the heat generating component (e.g. processor) directly to the coolant. The (heat) dissipation occurs away from the heat-generating component in a separate heat exchanger or dissipater and not at the component which is what happens with a heat sink or heat pipe.

As mentioned above, Cheon does not teach the use of peltier device as "the heat transfer unit." Cheon has a separate, conventional (for liquid cooling systems) heat transfer device (22) with liquid passing there through to absorb heat. Cheon also discusses another embodiment where the peltier device is deployed between the heat transfer device and the heat-generating component to "supposedly" facilitate the transfer of heat from between them. Applicant's invention eliminates the traditional heat transfer device (22) as explained above.

Both Cheon alone or Cheon in combination with Law do not teach or anticipate the coupling of the hot region (of the electron conducting material (e.g. peltier device)) to the conduit with coolant therein. When using multiple electron conducting materials, Cheon alone or in combination with Law do not anticipate the placement cold regions adjacent to each other (with thermal coupling of the hot regions to the conduit (as in Applicant's claim 50) or with hot regions placed adjacent to each other as in Applicant's claim 51, since neither teach or anticipate the coupling of hot regions to the conduit.

With respect to claims 53 and 54, which are now amended to overcome the Examiner's procedural objection, applicant's submits that nothing in Cheon alone or in combination with Law teaches or anticipates interleaving electron conducting materials (or peltier effect materials) with heat-generating components so that multiple sides of heat generating components are cooled.

Applicant respectfully submits then, that all of its claims now in this application are in condition for allowance.

Should the Examiner have any further comments or issues, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***art.fisher@patentdominion.net***

Respectfully submitted,

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